SNC Manufacturing Co, Inc.

QUIET-TEL™

NOISE MITIGATION EQUIPMENT

Hotliner Application Note

TELECOM LINE CONDITIONER (TLC)

Introduction

These instructions are intended for telephone and power company personnel who plan to conduct tests to determine the need for an SNC Telephone Line Conditioner (TLC). The instructions explain the symptoms that may indicate the need for a TLC, what those symptoms mean in terms of the problem that needs to be remedied, and how to determine the proper location for a permanent TLC. All testing and installation procedures are explained in detail. SNC recommends that you read the entire set of instructions before you begin field testing.

A Message on Safety

SNC Manufacturing Co. is concerned about your safety. Read these instructions carefully. Pay strict attention to all DANGER, WARNING and CAUTION statements. When you see these statements, take heed - your personal safety, the safety of your co-workers, and the safety of your equipment may be at risk.

DANGER: Possibility of personal injury.
CAUTION: Possibility of service interruption.
WARNING: Possibility of equipment damage.

This safety alert symbol is used throughout these instructions to alert you to hazardous situations. When you see this symbol pay strict attention to all safety instructions that follow!

Contents

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1. SYMPTOMS

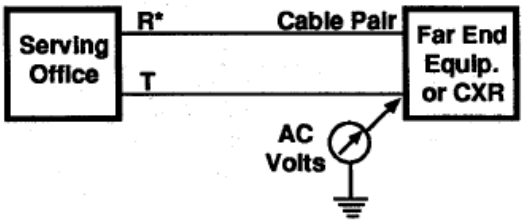
- Induced AC voltage affecting CPE equipment.
- False rings at user's equipment.
- Burned or damaged equipment — station, key system, PBXs, carrier terminals, data modems, etc.
- False signals: PBX, key system, alarm equipment, data terminal.
- Unexplained carrier or other electronic equipment failure.
- Noisy circuits.
- Chattering relays or equipment malfunctions: PBX, key system, alarm equipment, etc.
- "Hot" or "shocking to the touch" line facilities.
- Excessive "secondary" station protector operation.
- Impulse noise on data circuits.

2. PROBLEMS TREATED

- Susceptibility of the far end carrier or terminal equipment to:
  - (a) Steady-state 50/60 Hz longitudinally induced power line currents or voltages or induced lightning impulses which can impair or disable desired circuit functions and cause equipment damage.
  - (b) Longitudinally induced transient 50/60 Hz currents or voltages resulting from power line faults or surges that can cause impulse noise, component failures or damage.
  - (c) Excessive power influence levels (induced harmonic voltages or currents) that may cause circuit noise.

3. TEST PROCEDURES (FINDING THE SOURCE OF THE PROBLEM)

2.01 If you are experiencing any of the above symptoms refer to the tolerances in the literature that came with the terminal equipment or carrier system. The manufacturers know best the inductive tolerances that their equipment can handle. Follow their recommendations closely. If tolerance values are given, but no diagnostic procedure is provided, consider the following tests.



Idle Circuit	Busy Circuit
R to Ground:___VAC	R to Ground:___VAC
T to Ground:___VAC	T to Ground:___VAC

*** T and R are designated as a and b In some parts of the world.**

Figure 1

(a) If a voltage-to-ground (longitudinal voltage) tolerance value is provided, measure the AC voltage from each wire of the incoming serving facility (cable pair, drop wire, etc.) to an "approved ground" (this might be the existing protector ground). See Figure 1. These measurements should be made with the circuit in the idle (unused) and busy (used) condition. A high impedance AC voltmeter (>100 K Ohms) must be used to avoid "loading" the circuit. If any of these values exceeds about 50% of the equipment's stated voltage-to-ground tolerance value, an SNC TLC should be considered.

(b) If an interfering longitudinal AC current tolerance value is provided, consider the following the test. Using the manufacturer's circuit schematic, locate the equipment's longitudinal circuit path-to-ground. (This may be a capacitive path.) Place an AC ammeter in series with this ground path. Read the AC current value in both the busy and idle condition of the circuit. See Figure 2. If an AC ammeter is not available for this measurement an AC voltmeter and a 10 Ohm, 2 watt resistor can be used. Place the 10 Ohm resistor in the circuit's ground path instead of the AC ammeter as mentioned above. See Figure 3. Using an AC voltmeter measure the voltage drop across the 10 Ohm resistor. Divide the voltmeter reading by 10 and the result is the longitudinal AC current flow through the terminal equipment. Again, this current flow value through the equipment should be determined in both the busy and idle states. If either value exceeds 50% of the equipment's stated tolerance, an SNC TLC should be seriously considered.

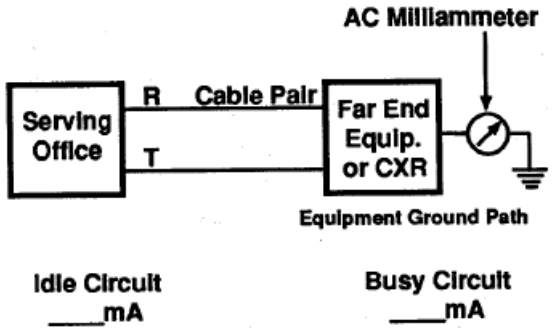


Figure 2

(c) If the equipment's circuit balance value is provided and the circuit does not meet its desired noise levels, measure the serving facility's Power Influence (PI) and Circuit Noise (CN). See Figure 4.

Note: PI equals noise-to-ground plus 40 dB (noise-to-ground plus voice message weighting).

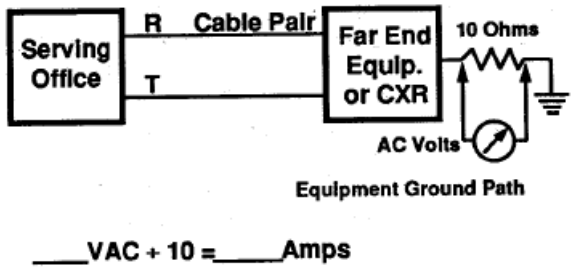


Figure 3

(d) These measurements are made using a standard telephone type noise measuring set, such as a Wilcom T136B or Western Electric 3C NMS. The serving facility should be terminated at the central office (or other similar location). This termination may be dialed up "quiet" or "balanced" termination, if the office is so equipped. It may also be an impedance matching type termination, or just a "short" and "ground" of the pair at the protector frame, as long as it provides a balanced association of the facility with ground at the serving office.

(e) Circuit Balance = PI – CN, so PI – Circuit Balance = CN. If the CN measured above exceeds the maximum desired noise value, little can be done to the user's equipment to improve the condition. However, if the CN meets the desired noise level but the PI minus the equipment's circuit balance is more than the maximum desired noise value, a TLC can be use to reduce the PI, which will in turn reduce the CN.

Note: This test is not applicable to carrier equipment.

2.02 If there is no equipment manufacturer's data

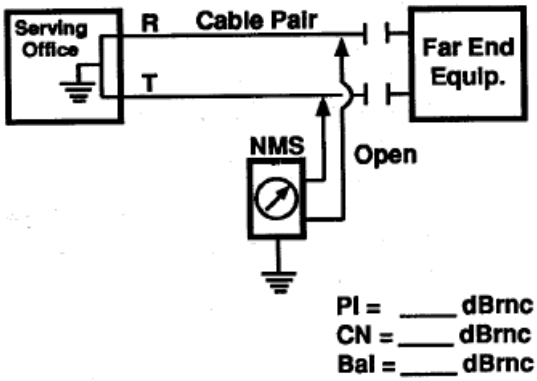


Figure 4

available or if the tolerances are not provided, the following values may be used. These values are not intended to recommend or reject any terminal equipment that will accept more or less than the values given:

- Longitudinally induced AC voltage-to-ground, less than 20–30 VAC.
- Longitudinally induced AC current through the equipment to ground, less than 5 ma AC.
- Power Influence of 80–90 dBrnc is marginal, but less than 80 dBrnc is generally acceptable, assuming the facility balance is greater than 60 dB. However, 80 dBrnc PI is high enough to cause noticeable CN if the equipment balance is less than 60 dB.

3. SOLUTION PRINCIPLES

3.01 End user's terminal equipment may be damaged by induced longitudinal AC voltages or currents. These voltages or currents can be induced into the serving facility by paralleling power lines, electric railroad catenaries, lightning, or other sources. Regardless of the source this interference needs to be controlled.

3.02 SNC's TLC is designed to mitigate this longitudinal AC interference. It consists of a 2, 6, 12, 25, 50 or 100 pair Induction Neutralizing Transformer (INT), a Transformer Exciting Network

(TEN), and a Harmonic Drainage Reactor (HDR). See Figure 5.

3.03 The INT is a multipair, telephone-type cable core, wound around a laminated steel core. It is designed to neutralize induced longitudinal AC interference when properly excited.

3.04 The TEN is a drainage reactor designed to have a low impedance-to-ground at 60 Hz while maintaining a high impedance across the T and R of the pair.

3.05 The HDR provides a relatively low impedance-to-ground over a broad range of harmonic frequencies, while maintaining a high impedance across the T and R of the pair.

3.06 The TEN and HDR are connected on the "EQPT" or station side of the INT. Because they have a low impedance-to-ground they provide an AC path for the longitudinal interfering currents to flow. This current path would flow through a pair in the INT portion of the TLC and to ground through the TEN and HDR. The currents flowing through the INT portion of the TLC excite it, causing a counter-longitudinal voltage to be produced which is 180° out of phase with the interfering influence. These voltages cancel, resulting in greatly reduced influences appearing on the equipment side of the TLC.

4. INSTALLATION NOTES

4.01 The first wire pair of the TLC should be assigned to a working circuit that has a relatively low longitudinal impedance path-to-ground at the central office, since the TEN and HDR portion of the TLC is bridged across that pair.

Installation

4.02 The TLC is available in 6, 12, 25, 50 and 100 pair sizes. It is provided with a reinforced plastic housing and is arranged to be mounted on a backboard. Mounting holes are provided through tabs at the ends of the housing.

4.03 The "LINE" and "EQPT" pairs into and out of the TLC are 10 foot long unshielded, twisted, unterminated, 26 gauge cable core. The TEN and HDR of the TLC are bridged on the first (white-blue) pair on the "EQPT" side. A ground terminal lug is provided on the under side of the TLC and must be connected to a "good" ground (low impedance) for proper operation.

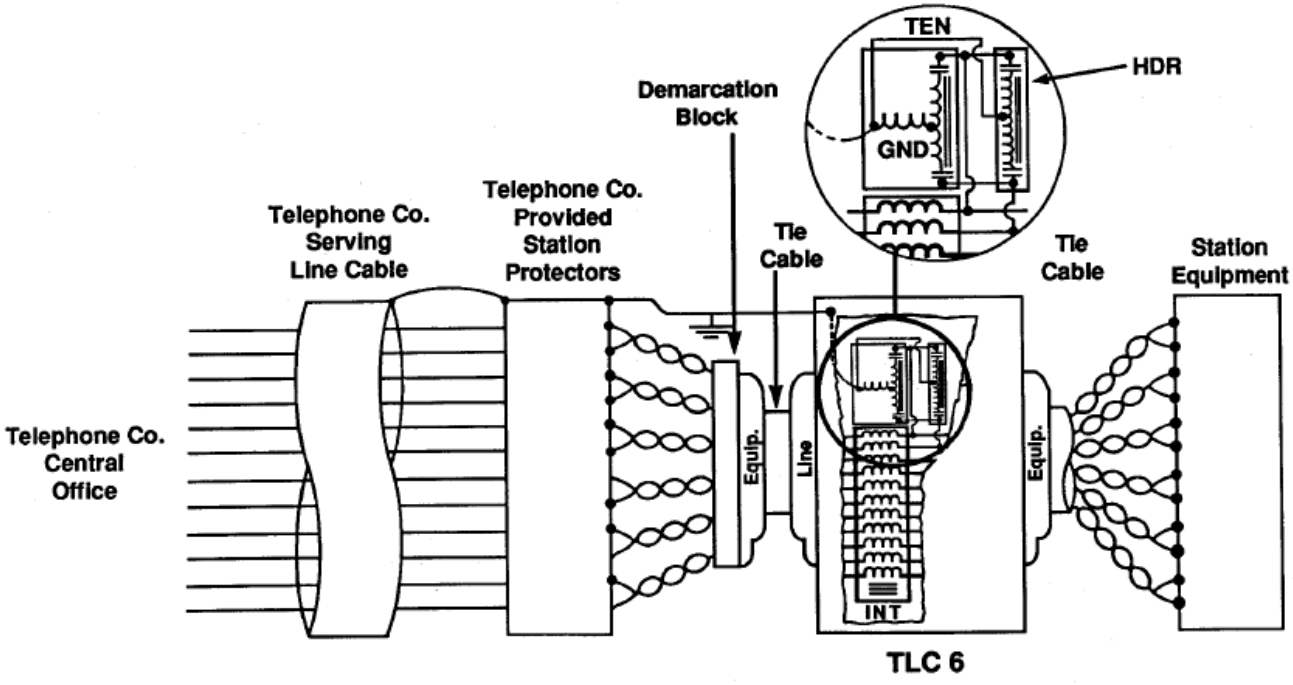


Figure 5: Typical TLC Installation

Note: An appropriate sized ground wire (up to #6 copper, depending on the number of cable pairs involved, should be connected to the ground lug. This ground wire should then be connected to an approved ground, normally the primary protector ground bus or possibly the single point ground, if one is designated.

4.04 SNC recommends locating the TLC between the telephone company provided primary station protection and the terminal or carrier equipment.

5. ADDITIONAL INFORMATION

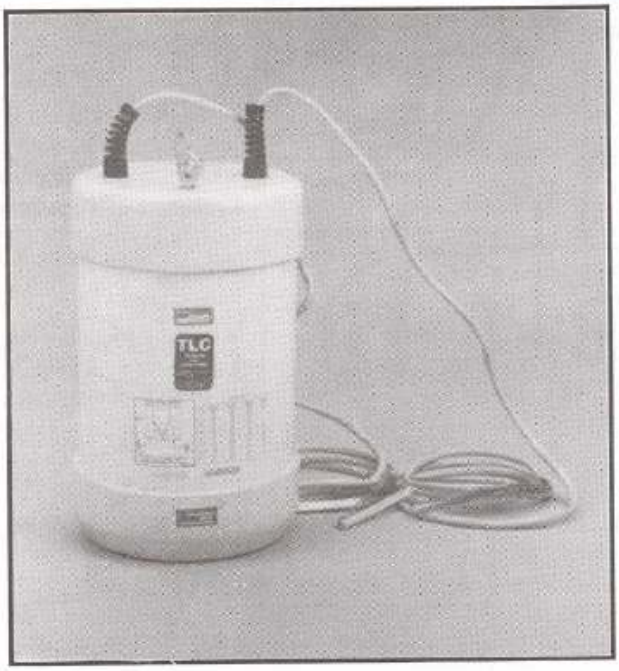
5.01 Although digital carrier signals will pass through a TLC, the attenuation and cross talk coupling at the high frequencies of digital carrier systems usually makes their use with these systems impractical. A digital INT should be considered for these applications.

5.02 Circuits with a DC path-to-ground, such as ground-start PBX trunks, tend to saturate the INT portion of the TLC. This makes the TLC less effective. Conversion to loop-start trunks is recommended. If this is not possible, additional TENs or a grounded exciting pair may be needed to achieve the desired results from the TLC.

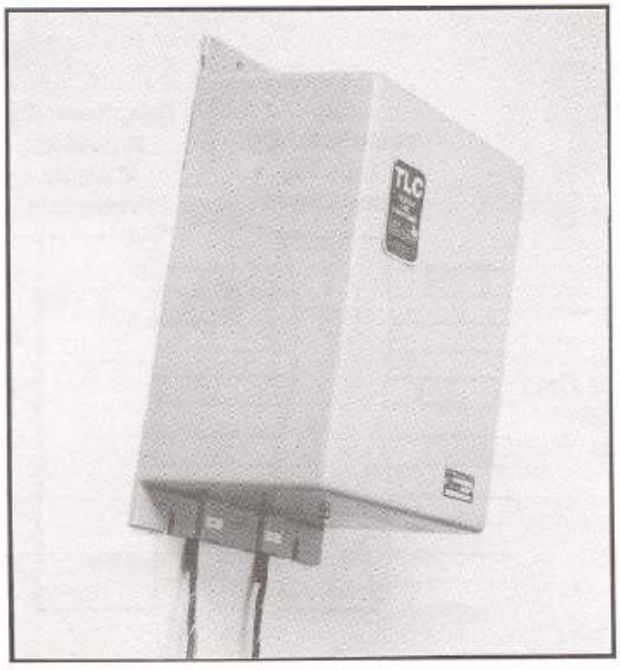
5.03 An SNC HumZapper test set is a very useful tool for determining how effective a TLC would be. The HumZapper can be easily be temporarily placed in a few of the circuits to make sure a permanent TLC will perform as expected.

5.04 The pairs into and out of the TLC are terminated to standard 3M ms^2 splice modules, which can be cut off if other termination is required.

5.05 The 50 and 100 pair TLC models are intended for floor or shelf mounting because of their size and weight.



50 or 100 pair TLC.



2, 6, 12, and 25 pair TLC.

Notes

Contact SNC Manufacturing Co. for further information on these quality Noise Solution products:

- Induction Neutralizing Transformer (INT)
- Digital Induction Neutralizing Transformer (DINT)
- Single Noise Interference Xterminator (SNIX)
- Noise Chokes
- Transformer Exciting Network (TEN)
- Harmonic Drainage Reactor (HDR)
- Glitch Tamer
- Telecom Line Conditioner (TLC)
- Harmonic Suppression Reactor (HSR)
- HumZapper
- Li'l Zapper

For further information or for technical support call 800-558-3325 – or visit – www.sncmfg.com

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